

REMARKS

Claim 1 has instantly been amended. Specifically, the limitation of claim 4 has been inserted into claim 1. Claim 4 has been cancelled accordingly. Claims 14 and 15 have been amended to correct the multiple dependency language. No new matter has been added by the present amendments.

Claim Rejections

II-1. Rejection of claims 1-5, 14 and 15 under 35 USC § 101 and 35 USC § 112, first paragraph

In the outstanding Office Action, claims 1-5, 14 and 15 are rejected under U.S.C. §101 because the disclosed invention is inoperative and therefore lacks utility. The Examiner states that the recitation of “porous silica layer is comprised of a plurality of moniliform silica strings” in claims 1, 14 and 15 is not supported by the specification. More specifically, the Examiner states:

that, while a dispersion of colloidal moniliform silica strings is present in a silica sol for coating (obtained by subjecting a mixture of a dispersion of moniliform silica strings and hydrolysable group-containing silane to hydrolysis and dehydration-condensation), nowhere is there a disclosure of how the structure of colloidal moniliform silica strings could be retained in the coagulated dehydrated gelled network or porous silica layer, and

that the absence of moniliform silica strings in the porous silica layer is further evidenced by Figs. 5, 7 and 9 of the instant invention, because they clearly show that the porous silica coating is a gelled network of silica particles, and nowhere a plurality of colloidal moniliform silica strings can found in these figures.

Further, claims 1-5, 14 and 15 are also rejected under U.S.C. §112, first paragraph for the same reason as mentioned above.

Applicants respectfully traverse.

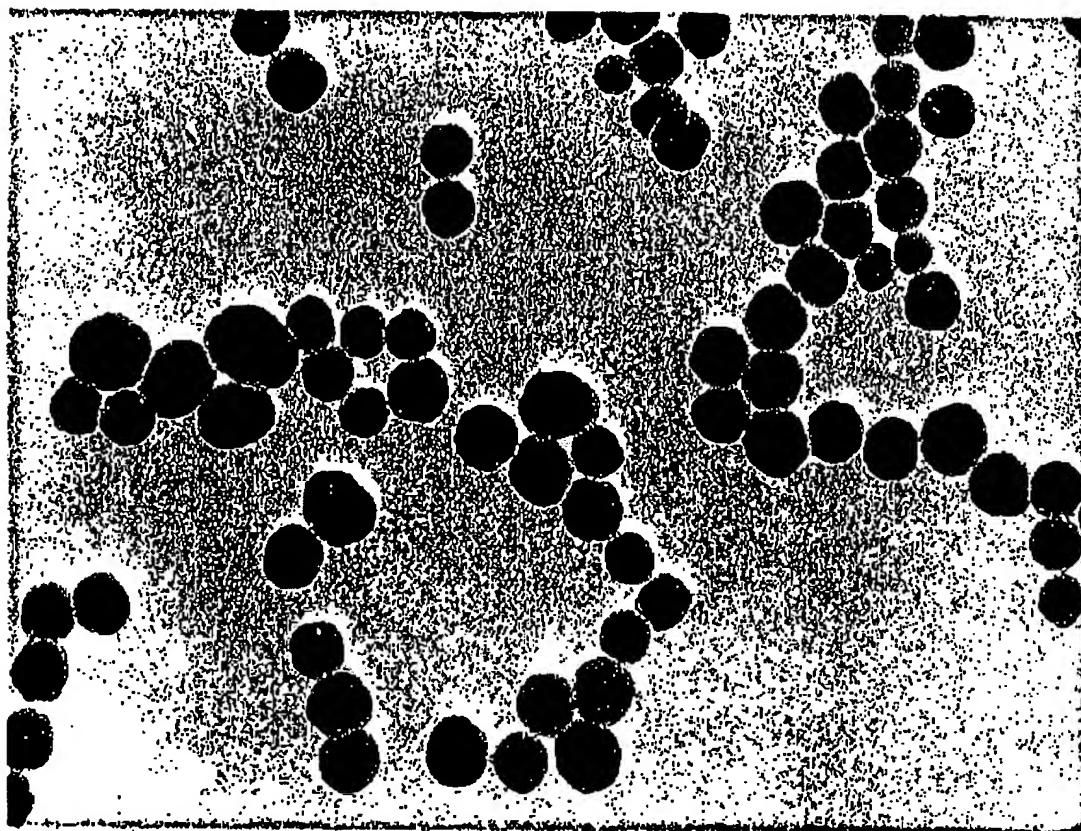
Firstly, it should be noted that Fig. 9 of the present application is a photomicrograph of a porous silica layer of a laminated structure obtained in **Comparative Example 7** in accordance with the **prior art**, wherein the porous silica layer was formed by coating on a PET substrate a coating composition containing **separate, non-linked** silica particles, and heating the resultant coating on the PET substrate at 120 °C.

On the other hand, Fig. 5 of the present application is a photomicrograph of a porous silica layer of a laminated structure obtained in Example 21 in accordance with the **present invention**, wherein the porous silica layer was formed by coating on a PET substrate a coating composition containing moniliform silica strings, and heating the resultant coating on the PET substrate at 120 °C.

From the comparison between Fig. 5 (showing a porous silica layer of a laminated structure in accordance with the present invention) and Fig. 9 (showing a porous silica layer of a laminated structure in accordance with the prior art), it is apparent that the moniliform silica strings are present in the porous silica layer of the laminated structure of the present invention.

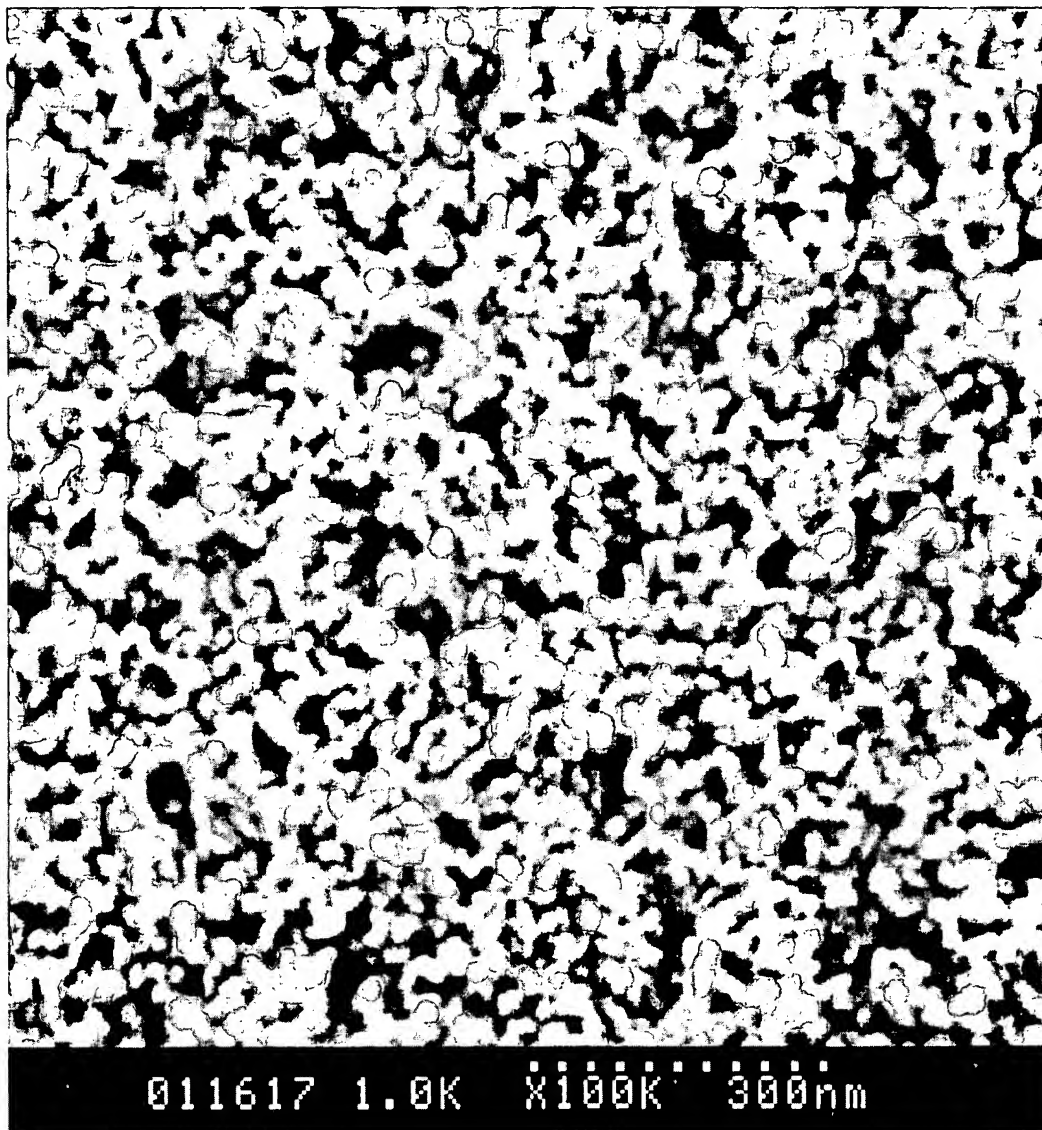
In the production of the laminated structure of the present invention as shown in Fig. 5, an aqueous dispersion of moniliform silica strings as shown in Fig. 2 of **Watanabe et al.** (US 6632489) is used. For easy reference, Fig. 2 of **Watanabe et al.** is reproduced below.

Fig. 2 of Watanabe et al.



As pointed out by the Examiner, in the production of a coating composition used to form the porous silica layer of the laminated structure of the present invention, the aqueous dispersion of moniliform silica strings is mixed with a hydrolysable group-containing silane, and the resultant mixture is subjected to hydrolysis and dehydration-condensation. By the use of such a coating composition, the moniliform silica strings as shown in Fig. 2 of **Watanabe et al.** are condensed and bonded to each other to form a structure as shown in Fig. 5 of the present application. For easy reference, Fig. 5 of the present application is also reproduced below.

Fig. 5 of the present application (showing a porous silica layer in accordance with the present invention)



As can be seen from Fig. 5 above, due to the presence of moniliform silica strings, the porous silica layer of the laminated structure of the present invention has a large number of large pores. This point is now more clearly expressed in instantly amended claim 1. Specifically, the formula (1) " $(S_{(a2+3\sigma)})/(S) \geq 0.5$ " recited in claim 1 means that the amount

of **large** pores is **50 % or more** in terms of a ratio of the total number of **large** pores [having their respective pore opening areas (a_1), each being independently at least 3σ **larger than** the average value (a_2) of the respective **maximum** cross-sectional areas of **primary silica particles** constituting the moniliform silica strings, wherein σ represents the standard deviation of the measured values of the maximum cross-sectional areas of said primary silica particles], relative to the total number of pore opening areas of all pores of the porous silica layer.

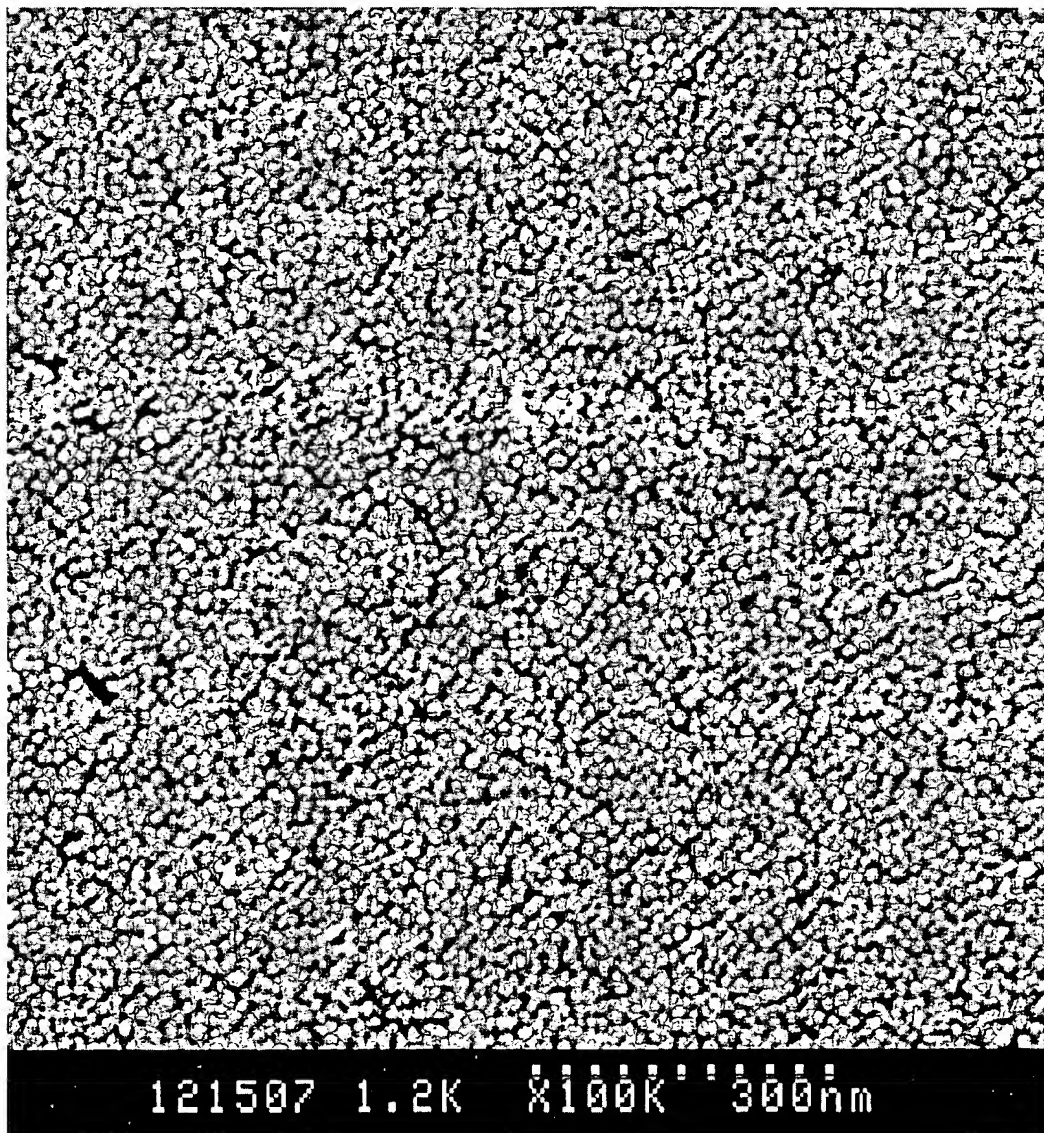
In this connection, attention is drawn to Fig. 6 of the present application, which is a graph showing the distribution of pore opening areas, the graph being obtained by an image analysis of the photomicrograph of Fig. 5. From the above-mentioned image analysis, it was found that the value of " $(S_{(a_2+3\sigma)})/(S)$ " was **0.68** (page 103, line 10 to page 104, line 1 of the present specification), which means that **68 %** of the pores of the porous silica layer were large pores, each having an area at least 3σ **larger than** the average **maximum** cross-sectional areas of **primary silica particles** constituting the moniliform silica strings.

If the moniliform structure of the silica strings is not retained in the porous silica layer of the laminated structure of the present invention, the porous silica layer could **not** have the above-mentioned large pores in such a large amount. This is apparent from Fig. 9 of the present application. More specific explanation is made below.

If the moniliform structure of the silica strings are not retained by, e.g., breakage of the moniliform silica strings during the formation of the porous silica layer, the silica particles (i.e., **primary silica particles** which once constituted the moniliform silica strings) should be substantially **closely packed** in the resultant porous silica layer so as to form a structure as shown in Fig. 9 of the present application, which shows a porous silica layer

formed by coating on a PET substrate a coating composition containing **separate, non-linked** silica particles. For easy reference, Fig. 9 of the present application is reproduced below.

Fig. 9 of the present application (showing a porous silica layer in accordance with the **prior art**)



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When the silica particles are substantially **closely packed** as shown in Fig. 9 above, the most of the pores of the porous silica layer naturally have areas each being smaller than the average **maximum** cross-sectional areas of **primary silica particles**, and the porous silica layer has **almost no** or **only very small amount** of the above-mentioned large pores, each having an area at least 3σ **larger than** the average **maximum** cross-sectional areas of **primary silica particles**.

In this connection, attention is drawn to Fig. 10 of the present application, which is a graph showing the distribution of pore opening areas, the graph being obtained by an image analysis of the photomicrograph of Fig. 9. From the above-mentioned image analysis, it was found that the value of $(S_{(a2+3\sigma)})/(S)$ was **0.13** (page 107, lines 2 to 8 of the present specification), which means that only **13 %** of the pores of the porous silica layer were large pores, each having an area at least 3σ **larger than** the average **maximum** cross-sectional areas of **primary silica particles**.

Thus, Fig. 5 of the present application clearly shows that the “porous silica layer is comprised of a plurality of monoliform silica strings”.

Further, the specification of the present application clearly describes that the “porous silica layer is comprised of a plurality of monoliform silica strings” (see, for example, page 34, lines 6 to 18 of the present specification), and also clearly describes the coating composition used for forming the porous silica layer comprised of a plurality of monoliform silica strings (see page 47, line 14 to page 63, line 11 of the present specification) and the method for forming the porous silica layer (page 63, line 12 to page 65, line 22 of the present specification).

From the above, it is apparent that the present specification clearly describes that the “porous silica layer is comprised of a plurality of moniliform silica strings”, that the present specification clearly describes how to obtain such a porous silica layer, and that the presence of moniliform silica strings in the porous silica layer is confirmed in the Examples of the present application.

Therefore, Applicants respectfully request that the Examiner withdraw the rejections under 35 U.S.C. §101 and 35 U.S.C. § 112, first paragraph.

II-2. Rejection of claims 1-5, 14 and 15 under 35 U.S.C. § 102(b) or 35 U.S.C. § 103(a)

Claims 1-5, 14 and 15 have been rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over **Lange et al.** (US 4816333). Specifically, the Examiner ignores the “moniliform silica strings” feature of the present invention for the reason as mentioned in connection with the rejection under 35 U.S.C. §101, and states as follows:

Lange’s average particle size reads on the average particle diameter of the instant invention of about 12-15 nm [specification, Examples 1, 13, etc.], and Lange also teaches that suitable porosity is critical to provide a refractive index between preferably 1.20 to 1.30, as claimed, a suitable size of the pore opening area and its relation to the primary particle size are reasonably considered to either anticipated by Lange, or a matter of obvious optimization or the reluctance to one of ordinary skill in the art of porous silica coated antireflective film.

Applicants respectfully traverse.

As already mentioned in item II-1 above, the laminate structure of the present comprises a porous silica layer comprised of a plurality of moniliform silica strings, and has

a large number of large pores such that the formula (1) " $(S_{(a2+3\sigma)})/(S) \geq 0.5$ " is satisfied. By virtue of this feature, the laminate structure of the present invention is **advantageous** in that the porous silica layer has not only **low refractivity** and **high light transmittance** but also **high strength**, so that the laminated structure can be advantageously used as an antireflection material, such as an antireflection film (page 1, lines 19 to 25 of the present specification). This advantage is clearly substantiated in the Examples and Comparative Examples of the present application.

On the other hand, **Lange et al.** teaches or suggests **neither** the moniliform silica strings **nor** the coating composition comprising the moniliform silica strings, and describes only the use of **separate, non-linked** silica particles. As clearly shown in the Comparative Examples of the present application, in the case of a production of antireflection film using such **separate, non-linked** silica particles, there is a trade-off between the optical properties (such as refractivity and light transmittance) and the strength. On this point, more specific explanations are made below.

As mentioned by the Examiner, **Lange et al.** relates to an antireflective polymeric substrate having a silica coating thereon, and the coating comprises a continuous gelled network of a porous coating having voids between the silica particles. As can be seen from Example 1 of **Lange et al.**, the coating is produced simply by applying a coating solution obtained by adding a colloidal silica to ethanol onto a substrate, followed by drying.

Substantially the same technique as used in the above-mentioned Example 1 of **Lange et al.** was used in Comparative Example 4 of the present application (page 95, line 22 to page 96, line 20 of the present specification). More specifically, in Comparative Example 4 of the present application, a silica coating was formed in substantially the same manner as

in Example 13 except that a water/ethanol dispersion of **separate, non-linked** silica particles was used as a coating composition instead of the coating composition of the present invention which comprises a dispersion of moniliform silica strings and a hydrolyzable group-containing silane. The silica coating obtained in Comparative Example 4 suffered scratches even with an HB pencil, namely the obtained silica coating had a **very poor** strength.

On the other hand, in Comparative Example 5 of the present application, the silica coating was formed in substantially the same manner as in the above-mentioned Comparative Example 4 except that a 10 % by weight aqueous solution of calcium chloride dehydrate was added (page 96, line 22 to page 97, line 17 of the present specification). The pencil hardness of the obtained laminated structure was 2H, which is improved as compared to the pencil hardness in Comparative Example 4. However, the laminated structure exhibited a minimum reflectance of 0.8 % at a wavelength of 55 nm, which is **disadvantageously high**.

The results of the above-mentioned Example 13, and Comparative Examples 4 and 5 are shown in Table 4 on page 111 of the present specification. For easy reference, Table 4 is reproduced below.

Table 4

	Hardcoat layer	Silica particles	Alkaline earth metal salt	Appearance of the coating	Minimum reflectance	Pencil hardness	Haze
Ex. 13	X-12-2400	Snowtex OUP (moniliform silica strings) 1g	10% $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ 0.092g	Uniform	0.15%	2H	0.15 %
Ex. 14	X-12-2400	Snowtex OUP (moniliform silica strings) 1g	10% $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ 0.127g	Uniform	0.15%	2H	0.20 %
Ex. 15	X-12-2400	Snowtex OUP (moniliform silica strings) 1g	10% $\text{CaCl}_2 \cdot 4\text{H}_2\text{O}$ 0.2g	Uniform	0.20%	H	0.20 %
Ex. 16	X-12-2400	Snowtex OUP (moniliform silica strings) 0.5g + Snowtex OXS (separate, non-linked silica particles) 0.75g	10% $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ 0.092g	Uniform	0.20%	2H	0.20 %
Comp. Ex. 4	X-12-2400	Snowtex O (separate, non-linked silica particles) 0.75g	Not added	Cissings were observed	-	Lower than HB	-
Comp. Ex. 5	X-12-2400	Snowtex O (separate, non-linked silica particles) 0.75g	10% $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ 0.092g	Uniform	0.80%	2H	-

From Example 13 and Comparative Examples 4 and 5 of the present application, it is apparent that the advantage of the laminated structure of the present invention over the laminated structures of the prior art as obtained in Comparative Examples 4 and 5 is attributed to the difference in structure between the silica layer in accordance with the present invention and the silica layer in accordance with the prior art, such as **Lange et al.** That is, the silica layer in accordance with the present invention is comprised of a plurality of monoliform silica strings as shown in the above-mentioned Fig. 5 and, hence, has a large amount of large pores, whereas the silica layer in accordance with the prior art, such as **Lange et al.**, is a continuous gelled network formed by the **separate, non-linked** silica particles as shown in the above-mentioned Fig. 9 and, hence, has only a **very small amount** of large pores.

From the above, it is apparent that the present invention is neither anticipated by nor obvious over Lange et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejections under 35 U.S.C. §102(b)/ 35 U.S.C. § 103(a).

Conclusion

In view of the foregoing, it is firmly believed that all rejections of the claims have been overcome. Early and favorable action is respectfully solicited.

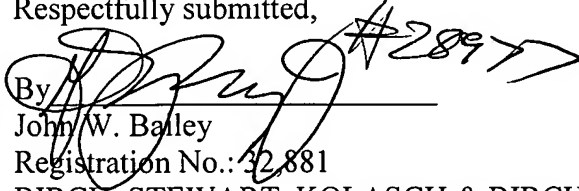
In view of the above amendment, applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John W. Bailey, Reg. No. 32,881 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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